Important Heat Input in Welding Formulas PDF

Formulas
Examples
with Units

List of 11
Important Heat Input in Welding Formulas

1) Heat required to Melt Joint Formula

Evaluate Formula

Formula

$$H_{req} = M_{fp} \cdot \left(\left(C_p \cdot \Delta T_{rise} \right) + L_f \right)$$

Example with Units

$$8.0475\,\text{KJ} = 0.5\,\text{kg} \cdot \left(\left(1.005\,\text{kJ/kg*K} \cdot 16\,\text{K} \right) + 15\,\text{J/kg} \right)$$

2) Heat Transfer Efficiency Formula

Evaluate Formula

Formula

$$\alpha = \frac{h_{net}}{H}$$

Example with Units

$$0.9501 = \frac{20\,\text{KJ}}{21.05\,\text{KJ}}$$

3) Melting Efficiency Formula

Evaluate Formula

Formula

$$ß = \frac{H_{req}}{h_{net}}$$

Example with Units

$$0.4024 = \frac{8.0475\,\text{KJ}}{20\,\text{KJ}}$$

4) Net Heat per Unit Volume available for Arc Welding Formula

Evaluate Formula

Formula

$$h_v = \frac{P_{in}}{v \cdot A}$$

Example with Units

$$167.2727\,\text{J/m}^3 = \frac{46\,\text{W}}{5.5\,\text{mm/s} \cdot 50\,\text{m}^2}$$

5) Net Heat Supplied to Joint Formula

Evaluate Formula

Formula

$$h_v = \alpha \cdot EP \cdot \frac{I}{ß \cdot v \cdot A}$$

Example with Units

$$167.2405\,\text{J/m}^3 = 0.95 \cdot 20.22\,\text{V} \cdot \frac{.9577\,\text{A}}{0.4 \cdot 5.5\,\text{mm/s} \cdot 50\,\text{m}^2}$$

6) Power given Electric Current and Resistance Formula

Evaluate Formula

Formula

$$P = I^2 \cdot R$$

Example with Units

$$66.15\,\text{W} = 2.1\,\text{A}^2 \cdot 15\,\Omega$$

7) Power given Electric Potential Difference and Electric Current Formula

Evaluate Formula

Formula

$$P = V \cdot I$$

Example with Units

$$66.15\,\text{W} = 31.5\,\text{V} \cdot 2.1\,\text{A}$$

8) Power given Electric Potential Difference and Resistance Formula

Evaluate Formula

Formula

$$P = \frac{\Delta V^2}{R_p}$$

Example with Units

$$66.163\,\text{W} = \frac{18\,\text{V}^2}{4.897\,\Omega}$$

9) Rated Duty Cycle given Actual Duty Cycle Formula

Evaluate Formula

Formula

$$D_{rated} = D_{req} \cdot \left(\frac{I_{max}}{I_r}\right)^2$$

Example with Units

$$1.0163 = 0.42 \cdot \left(\frac{7\,\text{A}}{4.5\,\text{A}}\right)^2$$

10) Required Duty cycle for arc welding Formula

Evaluate Formula

Formula

$$D_{req} = D_{rated} \cdot \left(\frac{I_r}{I_{max}}\right)^2$$

Example with Units

$$0.4174 = 1.01 \cdot \left(\frac{4.5\,\text{A}}{7\,\text{A}}\right)^2$$

11) Total heat generated in resistance welding Formula

Evaluate Formula

Formula

$$H = k \cdot i_o^2 \cdot R \cdot t$$

Example with Units

$$21.0501\,\text{KJ} = 0.84655 \cdot 0.7\,\text{A}^2 \cdot 18.7950\,\Omega \cdot 0.75\,\text{h}$$

Variables used in list of Heat Input in Welding Formulas above

- **A** Area *(Square Meter)*
- **C_p** Specific Heat Capacity at Constant Pressure *(Kilojoule per Kilogram per K)*
- **D_{rated}** Rated Duty Cycle
- **D_{req}** Required Duty Cycle
- **EP** Electrode Potential *(Volt)*
- **H** Heat Generated *(Kilojoule)*
- **h_{net}** Net Heat Supplied *(Kilojoule)*
- **H_{req}** Heat Required *(Kilojoule)*
- **h_v** Heat Required Per Unit Volume *(Joule per Cubic Meter)*
- **I** Electric Current *(Ampere)*
- **I** Electric Current *(Ampere)*
- **I_{max}** Maximum Current New Add *(Ampere)*
- **i_o** Input Current *(Ampere)*
- **I_r** Rated Current *(Ampere)*
- **k** Constant to Account for Heat Losses
- **L_f** Latent Heat of Fusion *(Joule per Kilogram)*
- **M_{fp}** Mass in Flight Path *(Kilogram)*
- **P** Power *(Watt)*
- **P_{in}** Input Power *(Watt)*
- **R** Electric Resistance *(Ohm)*
- **R** Resistance *(Ohm)*
- **R_p** Resistance for Power *(Ohm)*
- **ß** Melting Efficiency
- **t** Time *(Hour)*
- **v** Travel Speed of Electrode *(Millimeter per Second)*
- **V** Voltage *(Volt)*
- **α** Heat Transfer Efficiency
- **ΔT_{rise}** Rise in Temperature *(Kelvin)*
- **ΔV** Electric Potential Difference *(Volt)*

Constants, Functions, Measurements used in list of Heat Input in Welding Formulas above

- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Time** in Hour (h)
  Time Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Millimeter per Second (mm/s)
  Speed Unit Conversion
- Measurement: **Energy** in Kilojoule (KJ)
  Energy Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Specific Heat Capacity** in Kilojoule per Kilogram per K (kJ/kg*K)
  Specific Heat Capacity Unit Conversion
- Measurement: **Latent Heat** in Joule per Kilogram (J/kg)
  Latent Heat Unit Conversion
- Measurement: **Energy Density** in Joule per Cubic Meter (J/m³)
  Energy Density Unit Conversion

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